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THE AMERICAN
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VOL. 105 NOVEMBER, 1933 NO. 11

EDITORIAL

BOTANICAL RESEARCH

FOR several thousand years the Chinese have prepared a much touted panacea from parts of a native herb—the Ma-Huang. They have used it, through countless centuries, in decoctions and boluses, for a multitude of ills and aches.

They had no idea that its active principle was α-hydroxy-β methyl-aminopropylbenzene—even though, to many, this may sound Chinese.

They did not know that it was a fairly specific vaso constrictor.

But they *did* know—they *must* have known, that it was a valuable medicament in some directions, otherwise they would not have used it for five thousand years.

It appeared upon the American medical firmament a decade ago, as a new discovery, and it has since found much success in practice. Ephedrine, as it is known, has taken its place beside a kindred drug from an animal source, epinephrine (recently synthesized from a coal tar base).

The two drugs are indispensable additions to the doctor's armamentarium.

Which only suggests that old-fashioned drug, empirically used by folks of countryside for countless generations, may prove a fruitful field for pharmaceutic research.

Elsewhere we have written that in a mad scramble to squeeze out of the coal tar barrel every available virtue, research has neglected the botanicals.

The temporary and spectacular successes of surgery, the over-zealous and frequently illogical zoological fads and the over-emphasized phase of bacterial medicaments, all have turned our eyes away from medicinal plant possibilities.

Our heads have been dizzied with serums, endocrines, vaccines, surgical tricks—ectomy this—otomy that—transfusions, infusions,

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delusions—adjustments, psychopaths, allopaths, neuropaths, homeopaths, and several other paths—and a few detours.

Yet it is certain that when research turns—and turns intelligently to an evaluation of the long since discarded commonplace drugs of the countryside, there will be found many valuable agents of therapy.

No one can convince this writer that grandmother's fresh drug infusions or old-fashioned teas of garden herbs, had no especial value. Too much neglected have been sage and chamomile, boneset and mullein, bitter apple and horse nettles, plantain and heal all, liver-wort and tansy, pumpkin seed and mallow—and a host of other herbs and parts of herbs that have served the countryside for centuries with their healing ministrations.

There is a real need of real research in these rather commonplace directions.

For so truly as the Peruvian bark furnished the specific to the dread malaria, the white poppy of India its soporific juice, the oil from wormseed its hookworm poison, the Indian chaulmoogra its leprosy cure, the ephedrine of Cathay's ma-huang its asthma specific—equally true is it that there is a myriad of other plant antidotes to pain waiting for proper appraisal. It is high time for a botanical renaissance.

Plant drugs have stood the test of time far longer than have the scalpel or virus or vaccine.

The fields for pharmaceutic research are still fallow—barely touched and to the real pioneer no field offers more promise of bounteous crop than does that of the dominion of God's green children, the botanical.

IVOR GRIFFITH.

DOCTOR OF SCIENCE

LAST spring the Pennsylvania State Council of Education gave its formal approval to a proposed amendment of the charter of the Philadelphia College of Pharmacy and Science. This amendment, which has since been obtained through court action, authorizes the College to confer the Degree of Doctor Science *in course,* thus making possible by this College a fuller development of graduate instruction in Pharmacy, Chemistry, Biology and in Bacteriology.

The approval of the State Department of Education followed upon a full investigation of the educational resources of the College—its faculty, its laboratories and equipment, its plans for graduate work and for research.

Graduate work leading to Doctor of Science will be offered only to candidates who have received the Baccalaureate Degree from this college or from another college or university of recognized standing. The candidate must also present credits in those under-graduate subjects which provide proper preparation for the studies which are to constitute his graduate course.

He must spend at least three college years (six semesters) in graduate study, and must present a thesis recording original research carried out under the direction of the faculty.

The Degree of Doctor of Science *in course* will be conferred only on candidates who have satisfactorily completed the assigned graduate course, demonstrated their scholarship by passing a comprehensive examination, have given evidence of resourcefulness and ability in original investigation, and have presented a thesis adjudged by the faculty as a creditable contribution to science.

Only those students who in their under-graduate work have given evidence of high ability will be accepted as candidates for Doctor of Science.

The courses offered to graduate students include the following: Standards of the U. S. Pharmacopœia and the National Formulary, Choice of Methods in Chemical Analysis, Food Analysis, Advanced Alkaloidal Analysis, Advanced Organic Synthesis, Advanced Physical Chemistry, Electrometric Methods of Analysis, The Analysis of Mixtures of Synthetic Medicinal Chemicals, Bio-chemistry, Plant Chemistry, Advanced Medical Bacteriology, Advanced Industrial Bacteriology, Sanitary Biology, Sanitary Chemistry, Sanitary Bacteriology.

The research problems for thesis work will be in fields of science connected with the aforementioned courses of graduate study.

It may appear to some that these times of business uncertainties are not propitious for the expansion of graduate work. But an educational institution must give heed to the fact that the present era is the Golden Age of Science, and indeed also of its applications. The manufacture of medicinal products and of foods, also sanitation, and other methods of health preservation, offer countless opportunities for scientific research. So the further development of graduate work at this time is most opportune. It makes possible greater service in fields in which this college has long been active and in which it is glad to increase its usefulness.

J. W. S.

EVIPAN ANÆSTHESIA.—R. Jarman and A. L. Abel give details ("Lancet," 5731, 18) of trials with evipan in 100 cases. Evipan-sodium is the sodium salt of N-methyl-C-C-cyclo-hexenyl-methyl barbituric acid, which dissolves freely in water, though only solutions in non-aqueous organic vehicles are stable. The authors' conclusions are summarised as follows:—"In our considered opinion evipan is a useful addition to the surgical armamentarium, provided reasonable precautions be taken. The drug should never be used single-handed, since it is essential that the patient's airway should be continuously maintained. Moreover, in case of respiratory embarrassment we always have carbon dioxide and oxygen readily available, together with coramine and lobeline. Evipan is not, we believe, suitable for feeble or toxæmic patients, or those with cardiac or respiratory failure. As there is evidence of its detoxication by the liver, it should not be given to patients with jaundice. Until the drug has been more widely used, we feel that it should be administered only by an expert anæsthetist who will not only be able to maintain the airway and apply restoratives if necessary, but will also be ready to give a general anæsthetic should the operation take longer than is expected."—Through *Chem. & Drugg.*

ORIGINAL ARTICLES

*COMPARATIVE STUDY OF THE ASSAYS OF CINCHONA BARK

By Margarethe Oakley

Introduction

IT WAS thought that an accurate titration method for assaying the bark would be preferable to the present cumbersome gravimetric method in which the presumably purified alkaloids are weighed.

Theoretically there are suitable indicators available, but in practice these have not proved satisfactory and the gravimetric method is therefore still employed in the United States Pharmacopœia. The following experimental work has as its purpose the critical evaluation of several of the more recently suggested volumetric methods for the assay of Cinchona Bark with a view of determining which one might serve as an adequate substitute for the official gravimetric method.

Experimental

Titrations With Acid-Base Indicators

The investigation was begun by dissolving 200 milligrams of purified mixed Cinchona alkaloids in alcohol, adding tenth-normal hydrochloric acid in excess and the residual acid was titrated.

Methyl red and brom-cresol-purple were compared as indicators in this titration (M. R. official in the German Pharmacopœia (1) and B. C. P. suggested by McGill (2) and Wales (3)). Neither was satisfactory. Methyl-red gave results which were too high and brom-cresol-purple had too uncertain an end-point for a titration indicator, as shown by the wide variations in results on eleven titrations. The first change of brom-cresol-purple to green was distinct enough and the results were concordant, but far too high. When, however, the second color change from green to purple was used as an end point the results varied widely, being as low as 191 and as high as 203 when 200 milligrams of pure alkaloid was employed.

*A portion of the thesis submitted to the Graduate Faculty of the University of Maryland in part fulfillment of the requirements for the degree of Master of Science.

Para-nitro-phenol, buffered to pH 6.2, suggested by Rasmussen and Schou (4), was found to give results even higher than methyl red.

Furthermore, through the courtesy of Harden, of Hynson, Westcott and Dunning, a series of the following new indicators were obtained. (These were described in the Journal of the American Chemical Society of 1929 (5) and commented upon by Kolthoff (6) in the same journal.)

1. Phenol-tetraiodo-sulfon-phthalein.
2. Phenol-tetrabrom-sulfon-phthalein.
3. Tetrabrom-phenol-tetrachloro-sulfon-phthalein.
4. Tetrabrom-phenol-tetrabrom-sulfon-phthalein.
5. Orthocresol-tetrachloro-sulfon-phthalein.
6. Dibrom-orthocresol-tetrachloro-sulfon-phthalein.
7. Orthocresol-tetrabrom-sulfon-phthalein.
8. Dibrom-orthocresol-tetrabrom-sulfon-phthalein.
9. Orthocresol-tetraiodo-sulfon-phthalein.
10. Dibrom-phenol-tetrabrom-sulfon-phthalein.

One of these, No. 10 Dibrom-phenol-tetrabrom-sulfon-phthalein, was very satisfactory. It had a distinct color change from yellow to bluish-green, at the pH transition of the alkaloidal salts; making it possible to obtain concordant results which agree with the theoretical values. The results of these titrations are shown in Table I.

TABLE I

Titrations with Dibrom-phenol-tetrabrom-sulfon-phthalein

Amount present	Amount found
200 milligrams	199 milligrams
200 milligrams	197 milligrams
200 milligrams	200 milligrams
200 milligrams	203 milligrams
200 milligrams	198 milligrams
200 milligrams	200 milligrams

Five mixtures of pure quinine, $[\alpha]_D^{15} = -116.2$ (C=2 solvent $CHCl_3$), quinidine $[\alpha]_D^{17} = +228.4$ (C=1.62 solvent $CHCl_3$), cinchonine, $[\alpha]_D^{17} = +215$ (C=0.455 solvent $CHCl_3$), and cinchonidine, $[\alpha]_D^{15} = -83.5$ (C=2 solvent $CHCl_3$), were prepared and samples of these mixtures were titrated using Dibrom-phenol-tetrabrom-sulfon-phthalein as an indicator. The results were calculated on the basis of 1 cc. of tenth normal acid being equivalent to 0.0309 gm. alkaloid. This factor is obtained by taking the average

of the molecular weights of the two isomers, quinine and quinidine, and the isomers cinchonine and cinchonidine. It is based upon the assumption that these are present in the mixture in equal proportions.

In Table II the various proportions in which the alkaloids were mixed are shown.

TABLE II

Sample	A	B	C	D	E
Quinine	1.000 gm.	1.000 gm.	1.028 gm.	2.513 gm.	1.785 gm.
Quinidine	1.000 gm.	1.000 gm.	.000 gm.	.065 gm.	.022 gm.
Cinchonine	1.000 gm.	1.500 gm.	1.369 gm.	.345 gm.	.420 gm.
Cinchonidine	1.000 gm.	.500 gm.	1.600 gm.	1.152 gm.	1.772 gm.

Samples A and B were made similar to those used by Krantz (7) in his work on a Potentiometric Assay of Cinchona. Samples C, D and E were made similar to the ratios of these for alkaloids found in Crown Barks (C), red barks (D) and hybrid barks (E) (8).

Table III shows titration results obtained using these various alkaloidal mixtures with Dibrom-phenol-tetrabrom-sulfon-phthalein.

TABLE III

Titration results using 200 milligram samples. Fiftieth normal sodium hydroxide was used to back titrate

Sample	A	B	C	D	E
Milligrams found	201	201	198	202	202
	199	202	199	198	201
	199	198	197	198	203
	198	198	199	202	202
	200	200	198	204	203
	198	202	197	202	201
	200	200	200	200	202
	200	202	200	200	202
	201	199	200	199	202
	200	199	198	201	202

The results of these titrations show clearly that the accuracy and precision of these titrations with Dibrom-phenol-tetrabrom-sulfon-phthalein are sufficient for the purpose intended. In addition the variations in the alkaloidal constituents composing the mixtures did not significantly influence the end result. It was deemed advisable, therefore, to attempt to use the titration procedure in the estimation of the alkaloidal residue obtained from Cinchona bark. For this purpose a dark red bark was used, ground to the fineness of No. 60 powder. It was furnished through the courtesy of the S. B. Penick Company. The drug was prepared for titration by the official United

States Pharmacopœial process, using the charge (5 gm.) specified and following the digestion with dilute hydrochloric acid, neutralization with ammonium hydroxide (28 per cent.) and one and one-half hours' shaking with ether-chloroform (3 + 1). This ether-chloroform solution of the alkaloids was evaporated and titrations were attempted on the dry crude alkaloids which were of a yellow or reddish brown tint. When these were dissolved in alcohol (10 cc.) and the excess of standard acid added, the color was quite pronounced. The indicator, which under the previous conditions was found satisfactory, showed only about 75 per cent. of the true alkaloidal content of the bark. Various insoluble white powders failed to augment the sharpness of the color change.

In view of the inapplicability of this method to the crude drug, a variation of the Christensen's (9) titration method was next attempted. R. Dubreuil (10) and N. Wattiez (11) have proposed assay methods for the bark, using the liberation of iodine from potassium iodate by the excess acid used to dissolve the crude alkaloid. In 1932, F. Sternon (12) reviewed each of these procedures.

Iodine Titrations

In this investigation, titrations were made of the excess acid in which pure mixed alkaloids had been dissolved. Ten cc. of a solution of potassium iodide and potassium iodate (3 gm. KI and 1 gm. KIO_3 in 100 cc. H_2O) were used and the liberated iodine titrated with fortieth-normal sodium thiosulfate. The reactions which occur are described in the common treatises on iodimetry. The results obtained in the titration of the pure mixed Cinchona alkaloids are set forth in Table IV.

TABLE IV

Titration Results with Mixed Cinchona Alkaloids
Titration Method of Dubreuil

120 milligrams alkaloids present	124.8 milligrams found
140 milligrams alkaloids present	144.6 milligrams found
160 milligrams alkaloids present	165.6 milligrams found
200 milligrams alkaloids present	203.4 milligrams found
220 milligrams alkaloids present	228.0 milligrams found
220 milligrams alkaloids present	228.8 milligrams found
240 milligrams alkaloids present	242.6 milligrams found
260 milligrams alkaloids present	264.2 milligrams found
280 milligrams alkaloids present	279.2 milligrams found

These results were more variable than those obtained by titration of pure alkaloids using the dibrom-phenol-tetrabrom-sulfon-phthalein

indicator, but the titration of the crude alkaloids from the drug was more satisfactory than with the acid-base indicator and justified further work in this direction.

The procedure used in extracting the drug was the usual United States Pharmacopœial process to the point where the alkaloids are extracted into the ether-chloroform solution. This was evaporated, and the crude alkaloids dissolved in 10 cc. alcohol. A measured excess of standard tenth-normal sulfuric acid was added. Then using Dubreuil's suggestion, this mixture was poured into a 400 cc. beaker containing 10 cc. of the potassium iodide and iodate solution (prepared as previously described) with tenth-normal sodium thiosulfate, the exact equivalent of the standard acid used to dissolve the alkaloids. The mixture was then back titrated with tenth-normal iodine to the appearance of an excess of iodine causing the reacting mixture to take on a yellow-brown color.

Starch is of no value in these titrations as the iodized starch does not show its characteristic color in the mixture.

A preliminary series of determinations on the assay of the crude drug indicated that the iodometric titration suggested by Dubreuil was capable of yielding concordant results.

Silicotungstate Precipitations

The work done by Beal and North (13) in silicotungstic acid opened a way to check gravimetrically both the iodometric method and the residue from the United States Pharmacopœial method, weighed as alkaloids. These investigators precipitated quinine silicotungstate and cinchonine silicotungstate; determined their exact composition and also that of the acid and of the acid anhydride. The alkaloidal silicotungstates are extremely insoluble in water. Their equation for the reaction producing these insoluble precipitates is

$$4H_2O.SiO_2.12WO_3.5H_2O + 2C_{20}H_{24}H_2O_2.H_2O \rightarrow 2H_2O.SiO_2.12WO_3.2C_{20}H_{24}N_3O_2 + 8H_2O.$$

These silicotungstates can be ignited at a high heat without fear of volatilization; the product remaining is the anhydride of silicotungstic acid $SiO_2.12WO_3$ (mol. wt. 2488.06). The anhydride is more than nine times as heavy as the average molecular weights of cinchona alkaloids (309) and the alkaloid silicotungstate is approximately eleven times as heavy. Thus it is a precipitation capable of great accuracy; for a variation of one milligram in weighing the

anhydride means a difference of only 0.1 milligram in the weight of the alkaloid.

Although the silicotungstate precipitate is flocculent and slow in filtering, nevertheless, when an aliquot representing only one gram of bark is used the time and trouble required to precipitate and filter the material is less than that required to carry out the shaking out process of the United States Pharmacopœia.

The procedure used in carrying out this method was to dissolve the crude alkaloidal extract from which the ether-chloroform had been evaporated, in approximately six-tenths normal hydrochloric acid. After making up to a definite volume in a volumetric flask an aliquot, representing one gram of bark, was pipetted from the solution. Into this aliquot, in about 100 cc. of the acid, was poured a calculated excess of 6 per cent. silicotungstic acid. The precipitate which formed immediately was stirred vigorously and then allowed to settle. The supernatant liquid was poured through a weighed Gooch crucible, followed by the heavy precipitate. A 1 per cent. hydrochloric acid solution was used for washing. The precipitate was dried at 100 degrees C. and then ignited at a red heat for at least twenty minutes, and weighed. The weight is multiplied by 0.2172 to give the weight of the alkaloid present.

Comparison of Methods

At this stage of the investigation the following facts have been demonstrated. First, the applicability of the acid-base indicator Dibrom-phenol-tetrabrom-sulfon-phthalein, in the titration of the pure mixed Cinchona alkaloids has been pointed out. Its use with alkaloidal residues from the crude drug was found to be disappointing. Second, the iodine method of Dubreuil was found to give promising results with the pure alkaloids and alkaloidal residues obtained from the crude drug. Third, the silicotungstic acid method of Beal and North gave concordant results in preliminary trials with the pure alkaloids and the crude drug.

There remained, therefore, the following problems not yet solved by this investigation. First, is the extraction procedure of the Pharmacopœia efficient in removing the alkaloids? Second, does the Pharmacopœial method yield results which are a measure of the exact alkaloidal content of the drug? Third, is it possible to supplement the Dubreuil iodimetric method or the silicotungstic acid method of Beal and North, and in so doing, obviate the shaking out process in the official procedure?

To answer the first question the following series of assays was conducted. Extractions were made by the United States Pharmacopœial method. The ether-chloroform solution from each flask was divided into two equal portions and evaporated to dryness and the residue weighed.

The results are shown in Table V.

TABLE V

Determination	Per cent. of Crude Alkaloids upon Evaporation of Ether-chloroform Solution	
1.	11.53	11.50
2.	11.51	11.50
3.	11.53	11.54

The results set forth in Table V show that if there is no manipulation of the ether-chloroform solution, results obtained upon evaporation in terms of crude Cinchona alkaloids are practically identical.

In a second series the ether-chloroform solution from each flask was divided into two equal portions and subjected to the United States Pharmacopœial shaking out process.

These results are shown in Table VI.

TABLE VI

Determination	Per cent. of Alkaloids by United States Pharmacopœial Shaking Out Process	
1.	11.32	11.47
2.	11.08	10.88
3.	11.06	11.30

These results show that the manipulation of the ethereal solvent by subjecting it to the shaking out process establishes an average difference between the results obtained from the drug in the same flask of approximately 0.2 per cent. Apparently, therefore, the official acid extraction procedure is capable of a high degree of accuracy. When deviations occur they seem to be inherent to the purification of the alkaloids by the shaking out process.

In pursuit of the answer to the second and third questions set forth in the foregoing paragraph the following series of experiments was conducted. In group one of this series the extraction process of the Pharmacopœia was adhered to. The ethereal solvent was divided into two equal portions (80 cc. each). One portion was evaporated to dryness and the weight of the crude mixed alkaloidal residue ascertained. After weighing, in each instance, the alkaloidal residue was assayed by the silicotungstic acid method to determine the relative amounts of alkaloids and extraneous matter in the residue.

The other portion of the ethereal solvent was subjected to the United States Pharmacopœial shaking out process and the purified alkaloids weighed in the prescribed manner. After weighing, these alkaloids were evaluated by the silicotungstic acid method as in the former instance.

The results of these assays are shown in Table VII.

TABLE VII

Comparison of the Silicotungstic Acid and United States Pharmacopœial Methods

No.	United States Pharmacopœial Method Per cent.	Silicotungstate Determination on Alkaloids Extracted by U. S. P. Method Per cent.	Crude Alkaloids by Evaporation of Ethereal Solvent Per cent.	Silicotungstate Determinations on Crude Alkaloids from Ethereal Solvent Per cent.
1	10.77	10.13	11.94	10.55
2	11.00	10.68	12.29	10.71
3	11.23	10.86	12.46	10.95
4	11.27	10.63	12.20	10.71
5	11.40	10.93	12.51	10.97
6	10.86	10.69	12.37	10.87
7	10.92	10.54	12.54	10.57
8	11.79	11.61	12.31	10.89
9	10.87	10.49	12.07	10.87
10	10.95	10.68	12.10	10.62
11	11.11	10.92	12.45	10.91
Mean	11.11	10.74	12.29	10.78

The arithmetic mean of the four series of determinations reveals a very interesting relationship. First, it is quite obvious that by the evaporation of the ethereal solvent without any manipulation, high results are obtained which are presumably due to the presence of resins and other impurities. By subjecting the alkaloids to the shaking out process the amount of residue expressed in percentage of alkaloid was diminished by approximately one per cent. The agreement of the means of the assays obtained by the silicotungstic acid procedures is striking. It should be emphasized however, that this value is approximately 0.5 per cent. lower than the value obtained by the official method. The author is inclined to believe that the silicotungstic acid method gives a value practically identical with the absolute quantity of pure alkaloids present. This opinion is based on the findings of Beal and North and also those of Dubreuil who have shown that this compound between silicotungstic acid and

the alkaloids occurs with stoichimetric precision. Besides it was possible by the use of this method on the pure alkaloids to recover over 99.5 per cent. of the theoretical yield.

In addition to the foregoing conclusions, a statistical analysis of the raw data reveal some very interesting relationships. The probable error of an individual determination was calculated by the formula (14)

$$r = \pm 0.6745 \sqrt{\frac{\Sigma(v^2)}{n - 1}}$$

In this $\Sigma (v^2)$ is the summation of the squares of the deviations from the mean, and n is the number of determinations, r being the probable error of a single determination.

The probable error of the series of determinations was calculated by the formula

$$R = \pm 0.6745 \sqrt{\frac{\Sigma(v^2)}{n(n - 1)}}$$

in which $\Sigma(v^2)$ is the summation of the squares of the deviations from the mean, n is the number of determinations, and R the probable error of the series.

The following values were obtained

Probable Error of	Single Determination Per cent.	Series Per cent.
1. United States Pharmacopœial Method	± 0.20	± 0.06
2. Silicotungstic Acid Precipitate on U. S. P. Residues	± 0.16	± 0.05
3. Crude Alkaloids by Evaporation of Solvent	± 0.13	± 0.04
4. Silicotungstic Acid Precipitate on Crude Alkaloids from Ethereal Solvent	± 0.10	± 0.03

Confining the discussion to the probable error of a single determination in each series one observes that the fourth series, i. e., silicotungstic acid precipitation of the crude alkaloids, has the smallest probable error.

Another group of determinations was conducted to compare the Pharmacopœial method with the iodine titration method of Dubreuil.

The procedure followed, with the exception of the titration, was identical with that set forth in the foregoing paragraph. The results of these determinations are shown in Table VIII.

TABLE VIII

Comparison of the Iodine Titration and the United States Pharmacopœial Methods

No.	United States Pharmacopœial Method Per cent.	Iodine Titration on Alkaloids Extracted by the United States Pharmacopœial Method Per cent.	Crude Alkaloids by the Evaporation of Ethereal Solvent Per cent.	Iodine Titration on Crude Alkaloids from Ethereal Solvent Per cent.
1	10.07	10.10	11.97	9.63
2	11.09	10.45	12.14	10.30
3	11.37	10.22	12.29	10.30
4	10.76	9.93	11.74	9.25
5	11.23	10.96	12.64	10.46
6	10.57	9.80	12.33	9.30
7	10.78	9.93	11.88	9.14
8	11.05	10.46	12.30	10.30
9	11.23	10.05	12.01	9.63
10	10.88	9.57	12.57	9.22
11	11.33	10.13	12.42	9.80
12	11.21	10.12	12.22	9.68
Mean	10.96	10.14	12.21	9.78

The arithmetic mean obtained shows a very significant relationship. The agreement of the mean obtained in the former series by the United States Pharmacopœial method with that obtained in this series by the United States Pharmacopœial method is indeed striking. The same remark can be made regarding the results obtained on the evaporation of the ethereal solvent directly. The values obtained by the iodine titrations were not particularly gratifying. First the agreement between the two means is not particularly close. Second, these values fall far lower than the results obtained with the silicotungstic acid. This is indeed worthy of special note as when this method was used with the pure alkaloids, viz, Table IV, results higher than the theoretical were obtained. In this connection it is interesting to observe that when the alkaloids were more impure, lower values were obtained. Probably this phenomenon is associated with the impurities remaining with the alkaloids after extraction.

Calculation of the probable errors of a single determination in each series by the formula given in the foregoing discussion, gives the following results:

	Probable Error Per cent.
1. United States Pharmacopœia	± 0.25
2. Iodine Titration on United States Pharmacopœial Residues	± 0.24
3. Crude Alkaloids by the Evaporation of Solvent	± 0.18
4. Iodine Titration on Crude Alkaloids from Ethereal Solvent	± 0.32

These calculations indicate that the iodine titrations are capable of a reasonable degree of accuracy, in the author's opinion; however they yield a value lower than that of the actual quantity of the pure alkaloid present. Besides the error seems to be dependent upon the amount of the resins and the other extraneous matter associated with the alkaloids.

General Conclusions and Summary

In this investigation various types of the newer acid-base indicators have been employed in the titration of pure cinchona alkaloids. The substance which seems to be best suited for this purpose, owing to the fact that it gives results closest to the theoretical values is dibrom-phenol-tetrabrom-sulfon-phthalein. The use of this indicator in the titration of the alkaloidal residues obtained in an assay extraction was found unsuitable.

The iodine method of Dubreuil and the silicotungstic procedure of Beal and North were employed on the mixtures of the pure alkaloids successfully. The iodine titration method of Dubreuil and the silicotungstic acid method were compared with the United States Pharmacopœial method. The official method of removing the alkaloids from the crude drug was found to be capable of a high degree of accuracy. In this comparison it was pointed out that by evaporation of the ethereal solvent without effort to purify, much extraneous material is weighed with the alkaloids. The shaking out process removes some of this impurity, but not by any means all of it.

The iodine titration gives low results on residues obtained in the assay.

The silicotungstic acid precipitation gives concordant results and may be employed without subjecting the alkaloid to the shaking out process.

In view of this study and the statistical data set forth the following procedure, which eliminates the shaking out process, is recommended.

Weigh 5 gm. of the powdered (No. 60 fineness) bark into a 500 cc. Erlenmeyer flask. Add 15 cc. of 3 per cent. hydrochloric acid. Mix so that the bark is evenly wet. Digest on a water bath for one hour. Cool. Add 200 cc. ether-chloroform (3 parts ether and 1 part chloroform) and 10 cc. strong ammonia. Stopper and shake in a mechanical shaker one hour. Allow to stand over night. Shake for an additional thirty minutes. Decant 160 cc. of the ethereal solvent (representing 4 gm. of bark) and evaporate to dryness. Dissolve the crude alkaloids in 10 cc. of ether and add 100 cc. of approximately 0.6 normal hydrochloric acid. Warm on a water bath until the ether has evaporated, transfer to a 200 cc. volumetric flask and make up to the mark with the 0.6 N. acid. To a 50 cc. aliquot of this solution add 50 cc. of the 0.6 N. acid and 15 cc. of 6 per cent. silicotungstic acid. Stir vigorously and then allow to settle. Decant the supernatant liquid through a weighed Gooch crucible, add the precipitate to the crucible and wash with 1 per cent. hydrochloric acid. Dry at 100 degrees C. and ignite at a bright red heat. Cool in a desiccator and weigh. The weight of the anhydride multiplied by 21.72 equals the percentage of alkaloid in the drug.

$$\frac{2 \times \text{average mol. wt. of Cinchona alkaloids} \times 100}{\text{mol. wt. of } SiO_2 \cdot 12WO_3} = 21.72$$

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THE CHEMICAL COMPOSITION OF CERTAIN FOODS

By Joseph Samuel Hepburn, A. M., B. S. in Chem., M. S., Ph. D.; N. Albert Fegley, B. S., M. D.; Keum Sung Sohn, B. S., M. D.; John Robert Cox, B. S.; Emerson Augustine Read, B. S., and Richard Franklin Wallace, B. S.

THE analyses of foods, reported in this paper, have been made by the junior authors, and included in their respective theses for the degree of Bachelor of Science of this College.

The *apple butter* was a "Pennsylvania Dutch" product. The *dried ale yeast* was manufactured as a by-product by a Canadian brewery. The *breakfast foods* were prepared products requiring no cooking. Those numbered I and II were derived primarily from rice, that marked III from wheat, and that designated IV from wheat and malted barley. Three samples of *cashew nut kernels* from different sources were analyzed. The raw sample consisted of the kernels as imported. The fried sample consisted of kernels which had been prepared for the market by frying in cocoanut oil. The fried and salted sample was examined only for its ash content. The *diabetic bread* was prepared from casein, palm nut flour and eggs. Ten loaves were analyzed, each loaf representing a separate baking. The weight of the individual loaf ranged between 111.0 and 137.3 grams, and had an average value of 126.6 grams. The average chemical composition is given in Table I, and the caloric values based thereon in Table II. The minimum and maximum per cents of each constituent found in the ten separate analyses were:

	Minimum	Maximum
Total Solids	57.04	74.06
Moisture	25.94	42.96
Crude Fat	14.02	20.25
Crude Protein	4.47	8.31
Ash	3.24	4.75
Nitrogen-free Extractives	30.59	42.26

The *gefüllter Fisch* was supplied by one of the students in whose home it had been prepared. The *pidan,* or Chinese preserved egg, was purchased from an importer in the "Chinatown" of Philadelphia. It was the size of a duck egg, and had been preserved by packing in a mixture of wood ashes, lime, salt, and tea infusion for an indefinite period of time, estimated to be between six months and two years.

The shell and adherent packing were removed and discarded. Both the white and the yolk were coagulated. The white was a transparent brown mass resembling a stiff coffee-gelatin, while the yolk was a grayish-green opaque mass. Small fern-like crystals were present, apparently lying upon the vitelline membrane. The *pineapple* (slices and syrup) was a diabetic food, canned without the addition of sugar. The *prunes* had been cooked as usual; the pits were removed and discarded; the juice was permitted to drain from the meat as completely as possible; and each was then analyzed. In the lot purchased, the average gross weight of a *red banana* was 197 grams, of which 28.4 per cent. was refuse (peel), and 71.6 per cent. edible portion. The *soy bean milk* was prepared in the Korean fashion by Dr. Sohn, a native of that country. Dry soy beans were soaked with twice their volume of water for twenty-four hours. Heat was then applied until the temperature of the mass had risen almost to the boiling point. The beans were then ground with the water; and the resulting mass was squeezed through a coarse linen bag. The white milky filtrate was the soy bean milk.

The *preparation of the sample for anaylsis* naturally varied somewhat. The liquids (pineapple syrup, prune juice, and soy bean milk) required no preparation except mixing. A meat grinder was used to comminute the cashew nut kernels, the diabetic bread, and the pineapple slices (from which all syrup had been removed by wiping dry), and thereby to obtain a uniform sample. The pidan was forced through a fine-mesh wire screen until a homogeneous mixture of white and yolk was obtained. The other foods were triturated in a mortar to produce a uniform sample.

The *methods of analysis* were essentially those of the Association of Official Agricultural Chemists (1). Samples were weighed in glass-stoppered weighing bottles. Total solids and moisture were usually determined in tared lead bottle caps. Drying was done at a temperature of 100 degrees C., in either an electric oven or a water-jacketed, gas-heated oven. If necessary, *e. g.*, with pineapple syrup, the solids were dried on sand. The total solids were usually used for the determination of crude fat or ether extract by means of the Butt extraction tube (2). The fat-free solids were then used for the determination of crude fiber. Ash was determined by incineration in a tared porcelain crucible at a low red heat in a muffle furnace. Crude protein was determined by the Gunning modification of the Kjeldahl method, using 6.25 as the factor to convert nitrogen into

protein. Nitrogen-free extractives, or digestible carbohydrates, were determined by difference.

With soy bean milk, total solids and moisture were determined in a tared porcelain dish; and the total solids were then incinerated to obtain the ash. The crude fat was determined by the Gottlieb-Röse method using a Röhrig tube.

Several of the foods contained no crude fiber. It was absent from the clear liquids (pineapple syrup and prune juice) and from the pidan. In the analysis of the diabetic breads, the fat-free solids uniformly dissolved completely during the determination of crude fiber, showing that no cellulose (crude fiber) was present. The soy bean milk was found to be free from crude fiber. A portion (25 cc.) of the milk was treated with sufficient 95 per cent. alcohol to produce complete precipitation. The coagulum was collected on a linen filter (such as is used in the crude fiber determination); and was rendered free from lipins by extraction with ethyl ether and petroleum ether. The fat-free residue dissolved completely on boiling with 1.25 per cent. sulphuric acid for thirty minutes.

The *results* of the analyses have been collected in Table I. Determination was also made of the calcium and phosphorus content of the soy bean milk after destruction of the organic matter, in the calcium determination by incineration, in the phosphorus determination by digestion with concentrated sulphuric acid. The total phosphorus present in 48.971 grams of the milk was finally weighed as magnesium pyrophosphate, and found to be equal to 0.091 per cent. phosphoric anhydride. The total calcium present in 24.7 grams of the milk was finally weighed as calcium sulphate, and found to be equal to 0.034 per cent. calcium.

The caloric value of each food was calculated, on the basis that each gram of protein or digestible carbohydrate yields 4.1 calories, and each gram of fat 9.3 calories. The weight of a 100 calorie portion of each food was also calculated. The results are presented in Table II.

TABLE I

Percentage Composition of Certain Foods

	Total Solids	Moisture	Crude Fat	Crude Fiber	Crude Protein	Ash	Nitrogen-free Extractives	Analyst
Apple Butter	51.36	48.64	1.12	0.82	0.41	0.16	48.85	E. A. Read
Ale Yeast, Dried	93.25	6.75	1.17	0.83	38.89	3.97	48.39	J. R. Cox
Breakfast Food I	85.50	14.50	1.12	0.54	9.13	0.26	74.45	J. R. Cox
II	92.79	7.21	0.50	0.20	6.21	0.09	85.79	R. F. Wallace
III	88.00	12.00	0.78	1.75	13.48	0.43	71.56	R. F. Wallace
IV	92.95	7.05	0.79	1.48	11.85	0.46	78.37	J. R. Cox
Cashew Nuts, Kernel, Raw	93.92	6.08	38.99	1.57	21.62	2.34	29.40	E. A. Read
Fried	98.80	1.20	52.44	1.73	28.72	2.50	13.41	E. A. Read
Fried and Salted						2.96		E. A. Read
Diabetic Bread	64.21	35.79	16.62	0.00	6.27	3.64	37.68	N. A. Fegley
Gefüllter Fisch	32.61	67.39	9.42	0.00	16.02	2.07	5.10	E. A. Read
Pidan	49.08	50.92	18.49	0.00	26.77	3.46		E. A. Read
Pineapple Slices	12.28	87.72	0.42	0.39	0.41	0.55	10.51	R. F. Wallace
Pineapple Syrup	11.80	88.20	0.00	0.00	0.08	0.27	11.45	J. R. Cox
Prune Juice	29.99	70.01	0.00	0.00	0.84	0.31	28.84	R. F. Wallace
Prune Meat	25.90	74.10	0.01	2.36	1.18	0.82	21.53	J. R. Cox
Red Banana	26.60	73.40	0.82	1.15	1.25	0.67	22.71	R. F. Wallace
Soy Bean Milk	6.92	93.08	2.35	0.00	3.50	0.46	0.61	K. S. Sohn

TABLE II

Caloric Value of Certain Foods

	Calories per 100 Grams				Grams in 100 Calorie Portion
	Fat	Protein	Carbohydrate	Total	
Apple Butter	10.4	1.7	200.3	212.4	47.1
Ale Yeast, Dried	10.9	159.4	198.4	368.7	27.1
Breakfast Food I	10.4	37.4	305.2	353.0	28.3
II	4.7	25.5	351.7	381.9	26.2
III	7.3	55.3	293.4	356.0	28.1
IV	7.3	48.6	321.3	377.2	26.5
Cashew Nuts, Kernel, Raw	362.6	88.6	120.5	571.7	17.5
Cashew Nuts, Kernel, Fried	487.7	117.8	55.0	660.5	15.1
Diabetic Bread	154.6	25.7	254.5	434.8	23.0
Gefüllter Fisch	87.6	65.7	20.9	174.2	57.4
Pidan	172.0	109.8		281.8	35.5
Pineapple Slices	3.9	1.7	43.1	48.7	205.3
Pineapple Syrup	0.0	0.3	46.9	47.2	211.9
Prune Juice	0.0	3.4	118.2	121.6	82.2
Prune Meat	0.1	4.8	88.3	93.2	107.3
Red Banana	7.6	5.1	93.1	105.8	94.5
Soy Bean Milk	21.9	14.3	2.5	38.7	258.4

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THE INDICATOR PROPERTIES OF p-NITROPHENYL-ACETYL-HYDRAZINE, 2,4-DINITROPHENYL-ACETYL-HYDRAZINE AND 2,4,6-TRINITROPHENYL-ACETYL-HYDRAZINE.

By Albert Bloom, B. Sc., and Arthur Osol, Ph. D.

CURTIUS and Dedichen (1) refer to the action of 2,4-dinitrophenyl-acetyl-hydrazine as "an indicator toward acid and alkali." A search of the literature failing to reveal any further investigation of this indicator property, a study of this compound, as well as p-nitrophenyl-acetyl-hydrazine and 2,4,6-trinitrophenyl-acetyl-hydrazine was undertaken.

The nitrophenyl-acetyl-hydrazines were prepared by acetylization of the corresponding nitrophenyl-hydrazines with an equivalent weight of acetic anhydride, using glacial acetic acid as the solvent and boiling the mixture for several hours in a flask attached to a reflux condenser. The precipitated nitrophenyl-acetyl-hydrazines were removed by filtration and recrystallized from alcohol. Using p-nitrophenyl-acetyl-hydrazine as an example the type reaction is as follows:

$$p\text{-}NO_2C_6H_4NHNH_2 + (CH_3CO)_2O = p\text{-}NO_2C_6H_4NHNHCOCH_3 + CH_3COOH$$

Table 1 contains a summary of the properties of the substituted hydrazines.

TABLE 1

	Description	Corrected M. P.	Nitrogen % Calc.	% Found
p-nitrophenyl-acetyl-hydrazine	coarse, yellow-brown needles	196.8° C.	21.5	21.3
2, 4-dinitrophenyl-acetyl-hydrazine	fine, golden-orange needles	209-210° C.	23.3	23.3
2, 4, 6-trinitrophenyl-acetyl-hydrazine	yellow plates	222-223° C.	24.5	24.2

The nitrogen was determined by the Kjeldahl method after reduction of the nitro groups with zinc in the first two compounds, while in the case of the trinitro derivative powdered aluminum was used.

In order to determine the applicability of the acetylized hydrazines as indicators, titrations were performed and compared with results obtained using methyl red as the reference indicator. The

volumetric solutions used were approximately tenth-normal. In alkalimetric titrations the color change was indistinct and unreliable. The possibility of saponification of the indicator with subsequent liberation of the corresponding phenylhydrazine seemed unlikely, as the faded alkaline solution did not show evidence of hydrazone formation upon acidification and addition of acetone.

Table 2 gives the quantity of sodium hydroxide solution required for the neutralization of 10 cc. portions of sulphuric acid using the several indicators. The color change for each indicator is also given. (The numerals refer to the indicator containing that number of nitro groups, while MR refers to methyl red.) The titrations were carried out in an atmosphere of hydrogen to exclude carbon dioxide which acts as an acid toward the indicators.

TABLE 2

					Acid	Alkaline
(1)	8.90 cc.	8.87 cc.	8.88 cc.	8.88 cc.	pale green	brown
(2)	8.86 "	8.86 "	8.85 "	8.86 "	pale green	reddish-brown
(3)	8.86 "	8.89 "	8.85 "	8.88 "	pale green	orange-brown
(MR)	8.90 "	8.90 "	8.88 "	8.90 "		

The color transition interval of each indicator was determined by adding 0.5 cc. of a 0.2 per cent. solution of the indicator in alcohol, to each of a series of tubes containing 5.0 cc. of a buffer solution, the pH value of which varied in intervals of 0.2 pH unit. The pH values of the buffers at which the full acid and full alkaline colors were developed were taken as the limits of the transition interval. Table 3 gives the observed color transition intervals.

TABLE 3

Color Transition Intervals (pH)

(1) 6.6 to 8.0 (using Clark KH_2PO_4-NaOH buffers).
(2) 7.6 to 9.6 (using Clark H_3BO_3-KCl-NaOH buffers).
(3) 9.0 to 10.6 (approximately, as the alkaline color fades rapidly. Kolthoff and Vleeschhouwer Na_2CO_3-$Na_2B_4O_7$ buffers used).

Finally, the apparent dissociation constants were determined according to the method of Salm (2), as well as with a Bausch and Lomb Hydrogen Ion Colorimeter, using the same buffer standards. The values are set forth in Table 4 in pK_1 units where

$$pK_1 = pH - \log \frac{C_b}{C_a}$$

C_b being the concentration of the basic form of indicator, C_a the concentration of acid form. The values of pK_1 are strictly accurate only for the kind and concentration of ions present in the buffer standard, at a temperature of 25 degrees C.

TABLE 4

Values of pK_1 at 25° C.

	Salm Method	Colorimeter Method
(1)	7.6	7.6
(2)	9.1	9.1

(3) Color fades too rapidly in alkaline solution to permit measurement.

Summary

p-Nitrophenyl-acetyl-hydrazine, 2,4-dinitrophenyl-acetyl-hydrazine and 2,4,6-trinitrophenyl-acetyl-hydrazine have been prepared and certain of their indicator properties determined. All three indicators were found to be satisfactory in the titration of strong acids. In the titration of alkaline solutions the indicators gradually fade and are unsuited for accurate titrations.

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Bottled Juices.—D. C. Carpenter (*Ind. and Eng. Chem.,* Ind., Ed., 1933, XXV, 932-934) have studied the influence of light upon sterile apple juice and kraut juice stored in white glass bottles. The red end of the spectrum darkens the color, while the blue end tends to fade the color of the juice. With apple juice, the red end improves the aroma and flavor, the blue end decreases both. With kraut juice, the red end changes the aroma and flavor and tends to produce the characteristic aroma of decaying cabbage, while the blue end tends to produce a sour, saline taste; yellow, blue-green, and blue light increase the turbidity; green light gives results next best to storage in the dark. For marketing beverage juices, they should be placed in containers of green glass, or else the clear white glass container should be wrapped in a transparent green cellulose covering. —*J. S. H.,* through *Jour. Fr. Instit.*

THE APOTHECARY IN THE BIBLE AND RELIGIOUS LORE

By John E. Kramer

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THE history of the profession of pharmacy is honorable and ancient, extending over a period of more than 5600 years. From the year 3700 B. C., the date of the earliest known prescription, to the present epoch-making era of modern pharmaceuticals, medicine and pharmacy have marched hand in hand in the never-ending fight against pain, sickness and disease.

That there was great sickness in Biblical times is evidenced in the manifold passages of the Bible describing Christ as the Divine Healer. His miraculous work seemed to be without bounds, for He cured the maim, the halt, the lame and the blind. It is also recorded that He cured dropsy, the dumb, the deaf, palsy, fever, leprosy, paralysis, issues of blood, impediments of speech, withered hands and other infirmities, multitudes of various unmentioned diseases, cast out devils (the insanity cases of today), and even raised the dead. Not only did Jesus do these things, but Elijah, Peter, Paul and others of the disciples performed similar wonderful acts.

Although many cures were effected, the afflictions that remained were numerous, according to Biblical writers, existent as punishment for sins and wrongdoing. An example of this is the plague of boils and blains in Egypt during Moses' time. Leprosy, too, was rampant during this period, with Lazarus believed to be the most noted sufferer of this dread disease, although there is no direct assertion of this in the Bible. Since that time unsegregated lepers have carried a warning bell known as a Lazarus bell. The authors of Holy Writ leave the impression, however, that from pure goodness of heart the cures predominated over the afflictions.

That leprosy was recognized as a menace to public health is shown in the thirteenth and fourteenth chapters of Leviticus, with descriptions for the determination of the presence of the disease, the segregation of the sufferer from his fellowmen, and the rites of cleansing. The fifteenth chapter considers uncleanness by a "running issue of the flesh" and the precautions necessary to prevent the spread of the affliction. It should be noted that the priests acted as diagnosticians and healers in these cases. Any cures were the result

of spiritual rather than medical aid, however, because the healing oils were used in a devout ritual rather than for any external application to the parts affected.

Asa, in the thirty-ninth year of his reign as King of Judah, was diseased in his feet, "yet in his disease he sought not to the Lord, but to the physicians." (II Chronicles XVI, 12.) It does not say whether or not he was cured at that time, but he died two years later. The same chapter tells of his burial, after his people had "laid him in the bed which was filled with sweet odours and divers kinds of spices prepared by the apothecaries' art."

It is interesting to note that in Egypt medicine and its administration was exclusively in the hands of the priests. The Israelites, however, appealed for aid to the prophets first, then to the physicians and apothecaries. It is also interesting to note that this race of people had great objection to bitter flavors, and made widespread use of the term "gall and wormwood" when describing anything unpleasant. The extent of this is noticed in Revelation VIII, 10 and 11, "And the third angel sounded, and there fell a great star from heaven, burning as it were a lamp, and it fell upon a third part of the rivers, and upon the fountain of waters.

"And the name of the star is called Wormwood: and the third part of the waters became wormwood; and many men died of the waters, because they were made bitter."

In the entire Bible there is no definite reference to any internal medicine. Most of the medicaments are for external use, ointments and similar preparations predominating. Perhaps the most familiar of such references to pharmacy is not to a medicine at all, but to a part of the religious life and ceremony of the day.

(EXODUS xxx, 22 to 38.)

"22. Moreover, the Lord spake unto Moses, saying,

23. Take thou also unto thee principal spices, of pure myrrh five hundred shekels, and of sweet cinnamon half so much, even two hundred and fifty shekels, and of sweet calamus two hundred and fifty shekels.

24. And of cassia five hundred shekels, after the shekel of the sanctuary, and of oil-olive an hin;

25. And thou shalt make it an oil of holy ointment, an ointment compound after the art of the apothecary; it shall be an holy anointing oil.

26. And thou shalt anoint the tabernacle of the congregation therewith, and the ark of the testimony.

27. And the table and all his vessels, and the candlestick and his vessels, and the altar of incense,

28. And the altar of burnt-offering with all his vessels, and the layer and his foot.

29. And thou shalt sanctify them, that they may be most holy: whatsoever toucheth them shall be holy.

30. And thou shalt anoint Aaron and his sons, and consecrate them, that they minister unto me in the priest's office.

31. And thou shalt speak unto the children of Israel, saying, This shall be an holy anointing oil unto me throughout your generations.

32. Upon man's flesh shall it not be poured; neither shall ye make any other like it, after the composition of it: it is holy, and it shall be holy unto you.

33. Whosoever compoundeth any like it, or whosoever putteth any of it upon a stranger, shall even be cut off from his people.

34. And the Lord said unto Moses, Take unto thee sweet spices, stacte, and onycha, and galbanum; these sweet spices, with pure frankincense: of each shall there be a like weight.

35. And thou shalt make it a perfume, a confection after the art of the apothecary tempered together, pure and holy:

36. And thou shalt beat some of it very small, and put of it before the testimony in the tabernacle of the congregation, where I will meet with thee: it shall be unto you most holy.

37. And as for the perfume which thou shalt make, ye shall not make to yourselves according to the composition thereof: it shall be unto thee holy for the Lord.

38. Whosoever shall make like unto that, to smell thereto, shall even be cut off from his people."

A shekel was equivalent to about fifteen pounds, and a hin contained about five and one-half quarts.

Many authorities and translators believe that the word apothecary in the foregoing quotation should be perfumer, which might seem to be more in keeping with the text. If that is the case, the word ointment should be changed to pomade to retain the meaning. The Hebrew root word "rakach," from which is translated the English "apothecary," "compound" and other words, makes an accurate translation difficult, but the general meaning of "rakach" is to mix well-cut spices with oil. This would suit either the apothecary or the perfumer.

Again in the book of Exodus, this time in the twenty-ninth verse of the thirty-seventh chapter, we read that Bezaleel, helping build a tabernacle at Moses' command, "made the holy anointing oil and the pure incense of sweet spices, according to the work of the apothecary."

After the Lord had spoken to Samuel, saying, "I have provided me a King among his (Jesse) sons," I Samuel XVI, 12, tells of the anointing of David, youngest son of Jesse. "And the Lord said, Arise, anoint him, for this is he. Then Samuel took the horn of oil and anointed him."

The Lord also gives instructions to Moses, in Leviticus XVI, 32, to inform Aaron, on the death of his two sons, that "the priest whom he shall anoint . . . shall make atonement." Anointment was, therefore, an act of petition as well as an act of honor.

In I Kings XIX, 15, the Lord tells Elijah to go to Damascus and "anoint Hazael to be king over Syria, and Jehu the son of Nimshi shalt thou anoint to be king over Israel: and Elisha the son of Shaphat of Abel-meholah shalt thou anoint to be prophet in thy room."

Christ, at Nazareth, reading from the book of the prophet Esaias, said, "The spirit of the Lord is upon me, because he hath anointed me to preach the gospel to the poor." (Luke IV, 18.) According to Peter, in Acts X, 38, John preaches, after the baptism at Galilee, "how God anointed Jesus of Nazareth with the Holy Ghost and power."

The Gospel according to St. John, in the third verse of the twelfth chapter, contains the story of Mary, sister of Lazarus, and her act of anointing the feet of Jesus with a pound of ointment of spikenard, in gratitude at the raising of her brother from the dead. This spikenard (Nardostachys Jatamansi) has been traced to the "jatama" of the Hindus, a species of valerian. Unlike our commonly known valerian, spikenard contains an oil like attar of roses and is exceedingly fragrant. A pound of ointment of spikenard was very costly, and Mary's act made Judas Iscariot ask "Why was not this ointment sold for three hundred pence, and given to the poor?" To which Jesus gave his very famous reply, "Let her alone: Against the day of my burying hath she kept this. For the poor always ye have with you, but me ye have not always."

When Jesus was in Bethany at the house of Simon, the leper, a woman anointed his head with precious ointment from a very costly alabaster box. Again the disciple questioned the wisdom of the act, suggesting that a contribution of a sum of money to the poor would have been more fitting. Once more Jesus replied, "The poor always ye have with you, but me ye have not always." (Matthew XXVI, 6-11.)

In Luke VII, 37 and 38, we read of still another woman, "a sinner," who anointed Jesus' feet with an ointment from an alabaster box, while the Saviour was partaking of a meal in the Pharisee's house.

The extent to which the act of anointment was carried is shown in the fortieth chapter of Exodus, where even the tabernacle of Moses is anointed with oil.

The question is asked in the fourteenth verse of the fifth chapter of James, "Is any sick among you? Let him call for the elders of the Church; and let them pray over him, anointing him with oil in the name of the Lord." Isaiah (I, 6), complaining of the conditions in Judah, bewails the fact that "From the sole of the foot even unto the head there is no soundness in it; but wounds, and bruises, and putrifying sores: they have not been closed neither bound up, neither mollified with ointment."

Other evidences of the value of this type of preparation are in Proverbs XXVII, 9, "Ointment and perfume rejoice the heart," and II Kings XX, 13, which tells of the precious silver, gold, spices and ointment possessed by Hezekiah, and which he proudly showed. Ointments, therefore, had a possessive value as well as a religious importance. But, says Ecclesiastes VII, 1, "A good name is better than precious ointment."

Another of the better known scriptural passages is in Ecclesiastes X, 1, "Dead flies cause the ointment of the apothecary to send forth a stinking savour, so doth a little folly him that is in reputation for wisdom and honour." The moral intended is apparent.

Even better known is the story of the Good Samaritan who poured the soothing and healing oil and wine on the wounds of the traveler. The external use of wine, probably using the alcoholic content as an antiseptic, is here established. As for its internal use there is record, in I Timothy V, 23, of Paul's admonition to Timothy to "Drink no longer water, but use a little wine for thy stomach's sake, and thine often infirmities." But a further admonition and warning appears in Proverbs that "Drunkenness destroys health."

Spiritual health is advised in Proverbs III, 7 and 8, "Fear the Lord, and depart from evil. It shall be health to thy navel, and marrow to thy bones." God, telling Jeremiah of the return of the Jews, warns the wicked (Jeremiah XXX, 13) "There is none to plead thy cause, that thou mayest be bound up: thou hast no healing medicines."

Of the three gifts of the Wise Men at the birth of Christ, gold, frankincense and myrrh, the latter two are familiar to the profession of pharmacy. The frankincense was probably the substance now known as Alibanum, from an Indian and African tree, Bosswellia.

This tree has a resinous exudation which hardens on contact with air, assuming a whitish-pink color and having an agreeable odor. Myrrh was the earliest known aromatic gum, but an error in translation, due to the similarity of root words in the original text, confused the myrrh of the Bible, which is now known as Mecca balsam, and the myrrh of modern times, which is an aromatic gummy resin of Balsamodendron myrrha, growing in Arabia and Abyssinia.

Another much spoken of external medicament was Balm of Gilead, a balsam from the Balsamodendron Gileadense, a tree of Arabia, very difficult to cultivate. This made the balsam very valuable, and an item of trade. The Ishmaelites who bought Joseph from his brothers were carrying Balm of Gilead, myrrh and spices to Egypt. (Genesis XXXVII, 25.) In the eleventh verse of the forty-sixth chapter of the prophecy of Jeremiah is the quotation, "Go up into Gilead, and take balm, O virgin, the daughter of Egypt: in vain shalt thou use many medicines, for thou shall not be cured." Gilead was a mountainous district in Palestine.

The duties of the physicians and the art of the apothecaries continued even after the death of their patients, as we find in two other references beside that of the death of Asa, mentioned before. In John XIX, 39 and 40, is the passage, "And there came also Nicodemus and brought a mixture of myrrh and aloes, about an hundred pound weight. Then they took the body of Jesus and wound it in linen clothes with the spices, as the manner of the Jews is to bury." Then from Genesis L, 2, "And Joseph commanded his servants the physicians to embalm his father, and the physicians embalmed Israel." And from the twenty-sixth verse of the same chapter, "So Joseph died, being an hundred and ten years old, and they embalmed him and he was put in a coffin in Egypt."

Other drugs mentioned in the Bible are olive oil, manna, nitre, incense and mandrake. Due again to difficulties in translating, it is not certain that the mandrake of Biblical times was that used in medicine today.

Curative properties were found in domestic substances as well as in those medicines that had to be brought from distant lands. When Hezekiah was ill with boils Isaiah said, "Take a lump of figs. And they took and laid it on the boil and he recovered." (II Kings XX, 7.) In Hezekiah's prophecy of the holy land (XLVII, 12), is the statement that trees shall grow, "and the fruit thereof shall be for meat, and the leaf thereof for medicine."

With all of this recognition of the art of the apothecary there is no one person in the Bible actually named as a member of that profession. In Nehemiah III, 8, Hananiah, who worked at repairing the walls of Jerusalem, is mentioned as a son of one of the apothecaries.

Christ, however, has been called the Divine Healer, and has also been pictured as an apothecary. In a church at Werder, near Potsdam, Germany, is a painting of Christ as an apothecary, indicating reverence for the Saviour's powers and also representing the ideal of the profession. Rembrandt, about 1649, completed an etching of "Christ Healing the Sick." This work of art is probably better known as the Hundred Guilder Print, that being its purchase price. The etching now hangs in the Metropolitan Museum of Art in New York City. An English manuscript of the fourteenth century is illustrated by a picture of Daniel, as an apothecary, destroying a dragon.

The third century apocryphal book of Sirach, the thirty-eighth chapter, states, "The Lord hath created medicines out of the earth. . . . In such doth the apothecary make continuation, and of his works there is no end." Medicines and the apothecary are mentioned many times, also, in the apocryphal book of Ecclesiasticus. Among much mention of medicines in Jewish lore of the times is a specific for King David's spells of melancholia, in the form of an after-dinner pill of aloes and myrrh, saffron, opium and spices, flavored and rolled with honey. It seems that even then, as now, overeating and injudicious selection of foods made for uneven tempers and poor company.

There also appears a "sal sacerdotale," said to have been used by Elijah, and to have been recorded by St. Paul.

Shortly after the beginning of the Christian Era the now familiar Rx sign came into general use on physicians' prescriptions. At that time its form was the astrological sign of Jupiter (♃), and was used to denote that the writer of the prescription was obedient to the state religion of Rome. The Emperor Nero, fiercely persecuting the Christians, restricted them from the practice of medicine. This ban lasted as late as the fourth century, in the time of Julian.

Christian influence in the healing arts was felt, however, in the fourteenth century, when the monks were very often the only available physicians and pharmacists in parts of Europe. These heroic

men helped carry these and the other sciences through the Dark Ages, when much else was lost to mankind.

As could be expected, then, medicines were given names of religious significance. Cinchona, a fever powder used and prescribed by the Jesuits, was called Powder of the Cardinals, Powder of the Fathers, and Jesuit's Powder.

Medicines were mixed and applied according to the time required to say certain prayers. For instance, an ointment might be considered incorporated sufficiently after the manipulator had repeated a prayer five times. The same ointment might be considered sufficiently rubbed into the affected part after the applicator had repeated that prayer twice. Although cures had been sought by incantations to the deities from the very earliest of times the religious significance of this procedure is secondary to the timing scheme, whereby each person was his own clock, and uniform results were obtained without the modern specifications of seconds, minutes or hours.

There was in the twelfth century a certain Jewish scholar and doctor, Rabbi Moses Ben Maimon, known as Maimonides, whose Oath and Prayer is a model of an idealistic medical creed, and shows his religious feeling and that of his time. It is as follows:

> "Thy Eternal Providence has appointed me to watch over the life and health of Thy creatures. May the love for my art actuate me at all times; may neither avarice, nor miserliness, nor the thirst for glory, nor for a great reputation engage my mind; for the enemies of Truth and Philanthropy could easily deceive me and make me forgetful of my lofty aim of doing good to Thy children.
>
> "May I never see in the patient anything but a fellow-creature in pain.
>
> "Grant me strength, time, and opportunity always to correct what I have acquired, always to extend its domain; for knowledge is immense and the spirit of man can extend infinitely to enrich itself daily with new requirements.
>
> "Today he can discover his errors of yesterday and tomorrow he may obtain a new light on what he thinks himself sure of today.
>
> "O God, Thou has appointed me to watch over the life and death of Thy creatures; here I am ready for my vocation.
>
> "And now I turn unto my calling: O stand by me, my God, in this truly important task; Grant me success! For without Thy loving counsel and support, man can avail but naught. Inspire me with true love for this my art and for Thy creatures; O grant that neither greed for gain, nor thirst for fame, nor vain ambition, may interfere with my activity. For These I know are enemies of Truth and Love of men, and might beguile one in profession from furthering the welfare of Thy creatures. O strengthen me. Grant energy unto both body and the soul that I might e'er unhindered ready be to mitigate the woes, sustain and help the rich and poor, the good and bad, enemy and friend. O let me e'er behold in the afflicted and suffering, only the human being."

In the ninth century, during the pseudo-religion of the time of Charlemagne, an ointment of the Twelve Apostles was a great favorite, containing twelve important ingredients, ostensibly one for each of Christ's chosen followers.

In the sixteenth century the Rosicrucians, led by Jacob Boehme and his associates, believed that the secret of the philosopher's stone "was concealed in the text of the Bible, and particularly in Revelation." This sect was a secret order, a combination of mysticism, occultism and chemistry.

Other religious lore contained many medicines. Myrepsus, a Turkish medical man of the thirteenth century, had in his book of formulas a "Salt of the Holy Apostles," which, when taken morning and evening with meals, would preserve sight, prevent hair from falling out, relieve difficulty of breathing and keep the breath sweet (halitosis?). He also mentions a "Salt of St. Luke," similar, but more complicated than the "Salt of the Holy Apostles." Both were, basically, mixtures of common salt and ground aromatic herbs.

To return to the Bible for a final quotation, we find a very promising and optimistic verse in Proverbs XVII, 22, "A merry heart doeth good like a medicine: but a broken spirit drieth the bones."

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FLUORESCENCE

By C. C. Pines

FLUORESCENCE is that property which some bodies have of producing light different in color from the mass of the material when exposed to strong sunlight or other illumination. Fluorescence phenomena can be readily produced by exposing certain materials to the action of ultra-violet light. Until recently apparatus for producing ultra-violet emanations was fairly expensive, but there is now available an inexpensive argon gas-filled ultra-violet glow lamp for general use.

This lamp which can be used in an ordinary electric lamp socket, consumes but 2½ watts and is claimed by the manufacturer to have a useful life in excess of 1000 hours, whether used constantly or intermittently. Emanations from the lamp are in the near ultra-violet range between 3300 and 3700 angstrom units and are not absorbed by glass, so that specimens being examined may be exposed under glass.

To try the argon lamp, a number of specimens of fluorite (the name fluorescence is derived from the mineral) were exposed to its emanations for some seconds in a dark room. Of the specimens exposed, four were found which produced, in each case, a bright blue color of great beauty. All fluorites (1) do not give this bright blue fluorescence, in fact some specimens give no particular color at all.

Upon examining a specimen of calomel (mercurous chloride) crystals with the argon lamp, a beautiful light orange red color was observed from most of the crystals, but there were a few crystals which remained colorless, these upon analysis proved to be mercuric chloride. For purposes of comparison with the mercury arc vapor lamp, calomel and a number of other specimens were exposed to both lamps. The following table shows the results of the examinations:

Specimen	Color Under Argon Lamp	Color Under Mercury Lamp
Fluorite	Beautiful Deep Blue	Deep Blue
Brucite	Pale Green	Pearl White
Aragonite	Very Pale Green	White
Willemite	Yellowish Green	Bright Green
Franklin Furnace Ore	Yellowish Green Spots	Bright Green Spots
Anthracene	Beautiful Bright Green	Yellowish Green
Berberine Sulphate	Bright Yellow	Intense Yellow
Berberine Hydrochloride	Bright Yellow	Intense Yellow
Calomel (powd.)	Pink	Light Orange Red
Mercuric Chloride (powd.)	White	White
Calomel (crystals)	Light Orange Red	Bright Orange Red
Mercuric Chloride (crystals)	Colorless	Colorless
Cinchonidine Bisulphate	Light Blue	Intense Blue
Sodium Salicylate	Blue	Bright Blue
Ammonium Salicylate	Blue	Bright Blue
Uranium Nitrate	Green	Deep Green
Uranium Acetate	Green	Deep Green
Rosin (Colophony)	Green, on fractured surface	White (milky)
Golden Seal (Hydrastis)	(Fresh fractured rhizome) Golden yellow	Intense Golden, yellow
Petrolatum (yellow)	Bluish to greenish-yellow depending on thickness of film	Color about the same, but more intense

More minerals than the first five specimens mentioned will produce fluorescence with the argon bulb (1)—specimens of calcite, wavellite, sphalerite and rhodonite from the college collection failed to produce any color, although specimens from certain localities do react. The presence of impurities, even in minute traces, will cause an otherwise inactive material to fluoresce, which explains to some extent why different specimens of the same mineral (from various localities) do not respond the same to ultra-violet light.

All of the colors recorded in this paper were observed using the argon bulb without a filter, so that there were considerable visible light rays present with the ultra-violet rays. For examining stamps and ink marks on paper if desirable to have only ultra-violet rays, special filters may be used which will cut out the visible light.

Chemical Laboratory of the Philadelphia College of Pharmacy and Science.

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MEDICAL AND PHARMACEUTICAL NOTES

PRESERVATION OF COSMETICS.—The esters of *para*-hydroxybenzoic acid possess a marked anti-microbic effect. In commerce they are met with under the names "nipagin," "nipasol," "nipabenzyl," and "nipakombin." Their harmlessness has been established, and, moreover, they are odorless, practically neutral, and do not irritate the mucous membranes or give rise to chemical reactions in the products in which they are incorporated. They may be employed in various preparations by first dissolving them in boiling water, or, where the presence of water is not desired, in alcohol or acetone. The sodium compounds may also be employed, and these dissolve readily in water. A combination of different esters is often more effective than one ester used alone. Free *para*-hydroxy-benzoic acid, unlike the corresponding *ortho*-acid (salicylic acid) has only a relatively weak action, but its esters are much more powerful than those of the latter acid. The following table shows the proportions of the various esters necessary for the preservation of cosmetic products:

	Nipagin per cent.	Nipasol per cent.	Sodium Nipagin per cent.	Sodium Nipasol per cent.
Extracts of drugs	0.1–0.2	—	—	—
Casein emulsions	0.25	0.1	0.3	0.15
Day creams	0.05–0.15	—	0.1–0.2	—
Creams containing 5–10 per cent. fatty bodies	0.1	0.1	0.12	0.12
Creams containing 10–20 per cent. fatty bodies	—	0.15	—	0.16
Creams containing above 20 per cent. fatty bodies	—	0.2	—	0.22
Creams containing lecithin, cholesterol, or hormones	0.25	0.05	—	—
Emulsions	0.1	0.05	—	—
Hair-fixatives (jellies)	0.1–0.2	—	—	—
Skin tonic oils, massage oils	—	0.15	—	—
Lipsticks	—	0.2	—	—
Mucilages of agar-agar, caragheen, gelatin, gum, pectin, tragacanth, etc.	0.1–0.2	—	—	—
Soaps	0.3	0.2	—	—
Hydrogen peroxide	0.1–0.15	—	—	—
Dental creams	0.1–0.2	—	0.15–0.25	—

—Bohm, *Parf. Mod.*, 1933, *27*, 373, through *Pharm. Jour.*

Formulas Proposed for the New British Pharmaceutical Codex.

Nebula Andrenalinae et Ephedrinae Oleosa.

Adrenaline	0.1 gramme
Ephedrine	20.0 grammes
Dehydrated Alcohol	125.0 millilitres
Hydrochloric Acid	a sufficient quantity
Menthol	20.0 grammes
Eucalyptol	8.0 millilitres
Castor Oil	500.0 millilitres
Peanut Oil, to make	1,000.0 millilitres

Add the adrenaline to the dehydrated alcohol and very cautiously add just sufficient hydrochloric acid to dissolve it, applying it by means of a glass rod which is dipped alternately into the acid and the alcoholic solution and shaking the mixture after each addition of acid. Dissolve the ephedrine, menthol and eucalyptol in the alcoholic liquid, mix with the castor oil and add sufficient peanut oil to produce the required volume.

Nebula Adrenalinae Aromaticae.

Adrenaline	1 gramme
Dehydrated Alcohol	125 millilitres
Hydrochloric Acid	a sufficient quantity
Eucalyptol	50 millilitres
Oil of Sweet Birch	20 millilitres
Castor Oil	500 millilitres
Peanut Oil, to make	1,000 millilitres

Add the adrenaline to the dehydrated alcohol and very cautiously add just sufficient hydrochloric acid to dissolve it, approximately 0.8 mil.; the acid may be conveniently applied by means of a glass rod dipped alternately into the acid and the alcoholic solution, and shaking the mixture after each addition of acid. When solution of the adrenaline is complete, mix with the castor oil, then add the eucalyptol, oil of sweet birch and sufficient peanut oil to produce the required volume.—From *Austr. Jour. Phar.*

Editorial note.—The practice hereabout is to use oleic acid in preference to the mineral acids. A slight heat is necessary to effect the solution of the solids in the oleic acid.

NEW MORPHINE SUBSTITUTES.—Dilaudid (dihydromorphine hydrochloride), prepared from morphine, dicodid (dihydrocodeinone hydrochloride) from codeine and eukodal (dihydroxycodeinone) from thebaine, are advocated as analgesics and respiratory sedatives. They are shown, by animal experiments, to have an action on respiration similar to that of morphine and to produce marked analgesia. Dilaudid was much more toxic than morphine, and eukodol than dicodid, which seems to lie midway between morphine and codeine. Dilaudid, like morphine and heroin, stimulates stomach and intestinal movements, dicodid intestinal movements chiefly, and eukodol stimulates both only slightly. Dilaudid and dicodid, like morphine and heroin, but, unlike eukodol, increase spinal reflexes and, in large doses, produce convulsions. Dilaudid, dicodid, and eukodol have little action on the circulation.—G. N. Myers (*Brit. Med. J.*, 1933, 3788, 282).

POISON SPIDERS.—Hayward states that the black widow spider is the chief poisonous spider in the United States. It has fangs and a poison sac and is capable of expelling a colorless venom containing a highly neurotoxic element. Persons may not know they are bitten, as the sensation is much like the extraction of a hair or the prick of a pin, and no local reaction follows immediately; the spider is frequently not seen. However, a small wheal is present, on the apex of which is found a puncture wound the size of a pinhead. Some itching and burning are noted at the time of the bite. A few hours later a purpuric spot may appear, soon followed by an area of induration and extreme soreness, and frequently a slough occurs at the site. This may be caused by the venom or local infection, for cases of pyelitis, cellulitis, septicemia and erysipelas have been reported following the bite of a spider. The general symptoms appear from ten minutes to several hours after the bite, depending on its location. Often there is severe pain radiating from the side of the wound and finally extending over the entire body, accompanied by nausea, vomiting, dyspnea, persistent hiccup, profuse perspiration and urinary retention. There may be edema of the face, urticarial rash covering the body, accompanied by intense itching, increased blood pressure, leukocytosis and a fever, which seldom reaches 102 F. The symptoms usually subside in a few hours and the patient is able to be about in two or three days. However, several deaths have been

reported as resulting from the bite of this spider. The treatment is symptomatic and includes sedatives, elimination and stimulation. Hypodermic injections of morphine are indicated and usually large doses are required; strychnine and caffeine are useful. Hot packs of a 50 per cent. solution of magnesium sulphate over the region of the bite give relief. Good results have been obtained by the use of convalescent serum, but as yet no serum has been manufactured from lower animals.—*Kansas Medical Society Journal, 34:* 247-290 (July) 1933, through *J. A. M. A.*

DINITROPHENOL IN OBESITY.—San Francisco papers of August 28 reported the death of Dr. Hans Gessnar, a graduate of the University of Vienna, who took an overdose of dinitrophenol with the idea of reducing his weight and, as the paper popularly put it, was "literally cooked to death." It is to be expected that, with the craze that has in the past few years affected the American public, and especially the feminine contingent thereof, for short-cuts to the sylph figure, proprietary products will begin to appear having for their essential drug dinitrophenol. One is already on the market, put out by the I. R. Rogers Chemical Company of San Francisco under the name of "Nox-Ben-ol." This preparation is advertised both to physicians and to the public. According to advertising matter on Nox-Ben-ol, it is a "Magnesia Nitroxybenzol product and is sold in package of 120 3-grain capsules (33-day treatment) through your physician and the drug trade." It appears, too, that the stuff is also being advertised over the radio. The dangerous possibilities of such exploitation are obvious when we learn through the *Journal of the American Medical Association* (*J. A. M. A. 101,* 3, 193) that the conclusions reached by scientific experimenters with the product are as follows: (1) Dinitrophenol possesses prompt and striking pharmacological actions, which are similar in animals and men. (2) The outstanding actions are sustained increases in metabolism and body temperature, enormous activity of all metabolic functions, and fatal pyrexia with excessive doses. (3) Doses within therapeutic range cause in man significant increases in metabolism without fever, which may be useful in treatment of obesity, hypothyroidism and similar depressed metabolic states. (4) There are limitations to and possible dangers from the use of the drug clinically. It should be used under strictly controlled conditions.

COLORED WATERPROOF DRAWING INKS—A shellac solution was prepared by carefully digesting on a water bath about 65 gm. of orange shellac in 500 mils of a solution containing one volume of ammonium hydroxide (s. g. 0.90) mixed with four volumes of water. When the shellac had completely dissolved, the solution was allowed to cool. The waxes present were removed by four extractions with a mixture of equal volumes of ethyl ether and petroleum ether (100 mils). Each extraction required about three hours to obtain a complete separation. After the last extraction the shellac solution was heated on the steam bath for two hours in order to eliminate all traces of the ethers. The solution was diluted with water until the shellac content was reduced to 10 per cent. One gm. of phenol and 3 gm. of borax were added and dissolved.

The stock solution thus prepared was used in making the samples of ink. Convenient batches of the ink were made by mixing 50 mils of the stock solution with 50 mils of an aqueous solution of the dye. The ink was then filtered to remove any insoluble material introduced by the dye.

The following dyes were used:

Dye	Color	Color Index No.	Schultz No.	Dye in 100 Ml. of Ink *Gram*
Erythrosine Yellow	Red	772	591	0.5
Brilliant Orange R	Orange	78	79	0.6
Chloramine Yellow	Yellow	814	617	0.4
Brilliant Milling Green B	Green	667	503	1.2
Wool Blue G Extra	Blue	736	565	0.5
Methyl Violet B	Violet	680	515	0.5
Benzamine Brown 3GO	Brown	596	476	0.8

At the end of two years all the dyes were in good condition.—E. W. Zimmerman, Bureau of Standards, Washington (*Ind. Eng. Chem.*, 1933, 25, 1033; through *Chem. and Druggist*).

SULPHUR AND ARTHRITIS—Cystine, a sulphur-containing organic compound, is deficient in the fingernails of persons suffering from arthritis, often known as "rheumatism of the joints," Dr. M. X. Sulli-

van and Dr. W. C. Hess of Georgetown University told the American Chemical Society at its Chicago meeting.

The two research men tried injecting colloidal sulphur into the blood stream of six arthritis patients. They found that the cystine in their subjects' fingernails returned to normal, and at the same time the symptoms of arthritis abated.

Drs. Sullivan and Hess are now working on the problem of the relation of certain microorganisms to arthritis. They state that the lowering of the cystine content of body tissues implies the presence of injurious substances resulting from the activity of such microbes.

AMYLASE OF HUMAN SALIVA—Amylase is the enzyme which hydrolyzes starch through the various dextrins to maltose. Its presence in the saliva has been known for over a century. W. Lloyd Adams and Victor C. Myers (*Jour. Dental Res.*, 1933, XIII, 311-322) have made an elaborate study of the amylolytic index of human saliva. This index may be defined as the per cent. of the starch which is hydrolyzed to reducing sugar when 0.01 cc. of saliva and 0.01 gram of soluble potato starch are incubated at a temperature of 40 deg. C. for 30 minutes at a total dilution of 1 :200. While the index ranged between 25 and 50 in a group of 26 normal persons, yet it remained unusually constant in a given individual; thus, during the course of 5 months, its maximum variation in one person was ± 2 units. The index was markedly influenced by the chloride and total phosphorus content of the saliva; an increase of either 79 per cent. in the chloride content or of 43 per cent. in the total phosphorus content was accompanied by an increase of 45 per cent. in the amylolytic index. The index decreased as much as 50 per cent. in persons with severe "colds," possibly as the result of excessive secretion of saliva, and tended to be high in persons susceptible to dental cavities.—(J. S. H., through *Jour. Fr. Inst.*)